

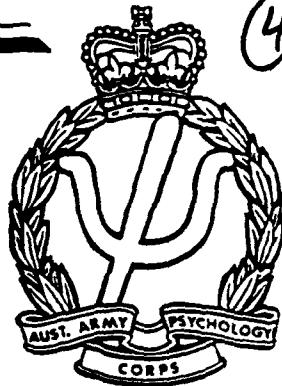
AD-A213 073

DTIC FILE COPY

RN 2/89

AR-005-064

(4)



FACTOR THEORY OF PERSONALITY WITH
PARTICULAR EMPHASIS ON CATTELL'S 16PF

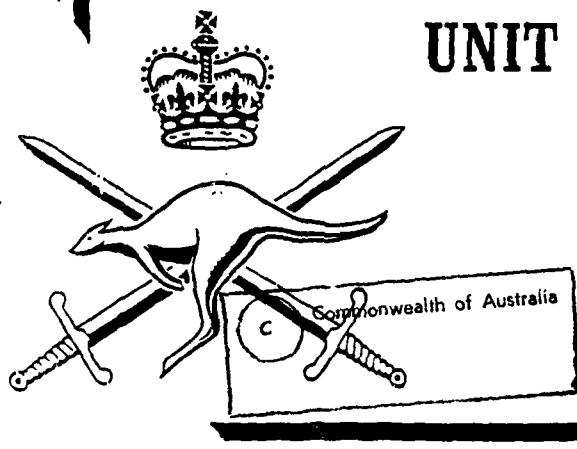
- A LITERATURE REVIEW -

BY

CAPTAIN J.L. EAVES

1st PSYCHOLOGICAL
RESEARCH
UNIT

DTIC
ELECTED
SEP 19 1989
S D
C B



APPROVED
FOR PUBLIC RELEASE

89 9 18 062

THE UNITED STATES NATIONAL
TECHNICAL INFORMATION SERVICE
IS AUTHORISED TO
REPRODUCE AND SELL THIS REPORT

Department of Defence
DOCUMENT CONTROL DATAPage Classification
UNCLASSIFIED

1a. A R Number AR-005-064	1b. Establishment Number PSRU-RN-2-89	2. Document Date March 1989	3. Task Number
4. Title Factor Theory of Personality with Particular Emphasis on Cattell's 16PF - A Literature Review		5. Security Classification (Place appropriate classification in box/s ie Secret(S), Confidential(C), Restricted (R), Unclassified (U))	6. No. Pages 31
8. Author(s) Captain J.L. Eaves		7. No. Refs 71	U document <input type="checkbox"/> title <input type="checkbox"/> abstract
10. Corporate Author and Address 1 Psych Research Unit NBH 3-39 Northbourne House TURNER ACT 2601 AUSTRALIA		9. Downgrading/Delimiting Instructions	
11. Office/Position responsible for - Sponsor Security Downgrading Approval			
12. Secondary Distribution (Of this document) Approved for Public Release			
Overseas enquiries outside stated limitations should be referred through the Document Exchange Centre, Defence Information Services Branch, Department of Defence, Campbell Park, CANBERRA, ACT 2601			
13a. This document may be announced in catalogues and awareness services available to			
No Limitations			
13b. Citation for other purposes (ie. casual announcement) may be <input type="checkbox"/> unrestricted or <input type="checkbox"/> as for 13a			
14. Descriptors Personality Testing 16PF Literature Review Factor Theory		15. COSATI Group 0092B	
16. Abstract The concept of personality is widely recognised as being central in psychology, yet its nature and the ways in which it can be defined and measured are questions on which psychologists are in considerable disagreement. While theorists tend to disagree over definitions of personality, they tend to agree that in order to perform a systematic exploration of personality's relation to other variables, a definite set of personality factors need to be specified. Researchers engaged in the question of the number of factors in the personality sphere seem to divide roughly into three positions: Two factors, five-to-eight factors, and 13-to-18 factors. Cattell devoted a major segment of his career to the development of the Sixteen Personality Factor Questionnaire (16PF). With the continuing use of Cattell's 16PF by the Australian Army Psychology Corps comes the need to review the available literature with a focus on its use			

1-

Page Classification
UNCLASSIFIED

This page is to be used to record information which is required by the Establishment for its own use but which will not be added to the DISTIS data unless specifically requested.

16. Abstract (Contd)

in personnel selection. The 16PF purports to measure 16 distinct personality traits, yet there is no evidence of the convergent validity of the 16 scales apart from factor loadings and what evidence there is of discriminant validity suggests the primary traits are not clearly differentiated. The psychometric adequacy of the test must be questioned. (S)

17. Imprint

18. Document Series and Number

19. Cost Code

20. Type of Report and Period Covered

21. Computer Programs Used

22. Establishment File Ref(s)

23. Additional Information (As required)

FACTOR THEORY OF PERSONALITY WITH PARTICULAR EMPHASIS ON CATTELL'S 16PF

- A LITERATURE REVIEW -

by

Captain J.L. Eaves

March 1989

This Directorate of Psychology publication has been prepared by
1st Psychological Research Unit and is authorized for issue by DPSYCH-A.

Sandra Richardson
S.M. RICHARDSON
Lieutenant Colonel
Commanding Officer
1st Psychological Research Unit
NBH 3-44
Northbourne House
TURNER ACT 2601

ISSN 0156-8817

Table of Contents

<u>Section</u>	<u>Page</u>
Table of Contents	1
List of Tables	iii
Abstract	3
Definition of Personality	5
Cattell's Total Personality Concept	7
Aim	8
Literature Review	8
Summary	24
Bibliography	27



Accession For	
NTIS	07-0001
DTIC	0000
Unnumbered	<input type="checkbox"/>
Justification	
By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or Special
A-1	

List of Tables

<u>Table</u>		<u>Page</u>
1	Five-to-Eight Factor Equivalence Table	15

Abstract

The concept of personality is widely recognised as being central in psychology, yet its nature and the ways in which it can be defined and measured are questions on which psychologists are in considerable disagreement. While theorists tend to disagree over definitions of personality, they tend to agree that in order to perform a systematic exploration of personality's relation to other variables, a definite set of personality factors needs to be specified. Researchers engaged in the question of the number of factors in the personality sphere seem to divide roughly into three positions: Two factors; five-to-eight factors; and 13-to-18 factors. Cattell devoted a major segment of his career to the development of the Sixteen Personality Factor Questionnaire (16PF). With the continuing use of Cattell's 16PF by the Australian Army Psychology Corps (AA Psych Corps) comes the need to review the available literature with a focus on its use in personnel selection. The 16PF purports to measure 16 distinct personality traits, yet there is no evidence of the convergent validity of the 16 scales apart from factor loadings and what evidence there is of discriminant validity suggests the primary traits are not clearly differentiated. The psychometric adequacy of the test must be questioned.

The findings and views expressed in this report are the results of the author's research studies and are not to be taken as official policy or opinion of the Department of Defence (Army Office).

Definition of Personality

The concept of personality is widely recognised as being central in psychology, yet its nature and the ways in which it can be defined and measured are questions on which psychologists are in considerable disagreement. There are few words in the English language which have such a fascination, even for the general public, as the term personality. According to Webster's Dictionary (1961) there are a number of alternatives:

The quality or state of being a person and not an abstraction, thing, or lower being.

The complex of characteristics that distinguishes a particular individual or characterises him in his relationships with others.

The totality of an individual's emergent tendencies to act or behave especially self-consciously or to act on, interact with, perceive, react to, or otherwise meaningfully influence or experience his environment.

The organisation of the individual's distinguishing character traits, attitudes, or habits. (p. 1687).

These alternative definitions convey some of the contradictions that plague the area of personality. The first alternative represents a rather global, philosophical point of view and one which psychologists consider too broad. The second definition does provide a firmer foundation for research, but exactly what characteristics or complex of characteristics should be examined? At one time or another almost every human attribute has been studied as a distinguishing characteristic, for instance, Sheldon's (1940) body-type theory of personality. The third definition emphasises the study of behaviour. It represents the view that if psychology is to be scientific, it must only deal with what is observable. Behaviour is observable, hence psychology must be the study of behaviour. However, one could add some confusion by asking whether behaviour is defined as including thinking. The fourth definition suggests consideration of individual character traits or habits. These are convenient ways to denote mental states that presumably underlie various behaviour patterns, yet are difficult to measure because they are hard to define.

It is obvious, therefore, that the word "personality" is used in various senses. However, most of these popular meanings fall under one of two headings. The first usage equates the term to social skill or adroitness. By this, Hall and Lindzey (1957) suggest that an individual's personality is assessed by the effectiveness with which he is able to elicit positive reactions from a variety of persons under different

circumstances. It is in this sense that schools which specialise in glamorising the female intend the term when they refer to courses in "personality training". Likewise, the teacher who refers to a student as presenting a personality problem is probably indicating that his social skills are not adequate to maintain satisfactory relations with his fellow students and the teacher. The second usage considers the personality of the individual to be described by the most outstanding or salient impression which he creates in others. Thus, Hall and Lindzey (1957) suggest a person may be said to have an "aggressive personality" or a "submissive personality". In each case the observer selects an attribute or quality which is highly typical of the subject and which is presumably an important part of the overall impression which he creates in others, and his personality is identified by this term. It is clear that there is an element of evaluation in both usages.

While the diversity in ordinary use of the word personality may seem considerable, it is overshadowed by the variety of meanings with which the psychologist has endowed this term. Some theorists list the traits considered to be of primary importance in describing the individual and suggest that personality consists of these. Other definitions place primary emphasis upon the integrative or organisational function of personality. Such definitions suggest that personality is the organisation or pattern that is given to the various discrete behaviours of the individual, or else they suggest that the organisation results from the personality which is an active force within the individual. Personality is that which gives order and congruence to all the different kinds of behaviour in which the individual engages. Other theorists have chosen to emphasise the function of personality in mediating the adjustment of the individual to daily activities. In that way, personality consists of the varied and yet typical efforts at adjustment which are carried out by the individual.

More time could be spent dealing with the problem of defining personality, however, it seems evident that no substantive definition of personality can be applied with generality. Hall and Lindzey (1957) concluded that the way in which a given individual will define personality will depend completely upon his particular purpose. That is, personality is defined by the particular empirical concepts which are a part of the theory of personality used by the observer. Personality consists concretely of a set of values or descriptive terms which are used to describe the individual being studied according to the variables or dimensions which occupy a central position within the particular theory utilised. The definition problem can be pursued in much more detail, yet it is evident that while theorists tend to disagree over definitions of personality, they tend to agree that in order to perform a systematic exploration of personality's relation to other variables, one must be able to specify the universe of traits that comprise personality. McCrae and Costa (1985) go on to say that, without a definite set of personality factors, research efforts are fragmented.

An analogy with chemistry, referred to by Marshon and Gorsuch (1986) helps explain why a set of agreed upon personality factors is needed. A well-defined taxonomy of personality would delineate the relations between personality factors as the periodical table of the

elements delineates interrelationships of chemical elements. The difference between an alphabetical listing of the elements and the periodical table is that the table allows chemists to express all compounds in a common vocabulary. That is, any chemical compound can be viewed as an amalgam of basic elements, and compounds that are similar in their elements have other important similarities. It is hoped that a taxonomy of personality would introduce similar clarity into the study of personality.

Cattell's Total Personality Concept

Cattell (1946, 1950, 1957, 1965, 1973) has devoted a major segment of his career to the development and refinement of his conception of the normal personality sphere and the primary instrument for its measurement, the Sixteen Personality Factor Questionnaire (16PF). Cattell (1957) describes the 16PF as the psychologist's answer, in the questionnaire realm, to the demand for a test giving fullest information in the shortest time about most personality traits. He goes on to say that it is not merely concerned with some narrow concept of neuroticism or "adjustment," or some special kind of ability, but sets out to cover precisely all the main dimensions along which people can differ, according to basic factor analytic research.

In applied fields such as clinical, educational and industrial psychology, Cattell suggests that the practitioner usually has a feeling that certain traits, for example, emotional stability, will be more important and predictive than others. However, Cattell (1957) goes on to suggest that in doing this the practitioner may overlook some other, unconsidered, personality dimension that is equally important. Cattell (1957) therefore, suggests that the best way to begin is to take cognizance of the TOTAL personality, in all its dimensions.

Despite the use of a comprehensive plan and extensive psychometric studies, Cattell's methods and results have not been totally accepted by other personality psychologists, for example, Eysenck and Eysenck (1969) and Buss and Finn (1987). Furthermore, many of the detractors used the same psychometric procedure, that is, factor analysis, to cast doubt on the conception of the normal personality that Cattell used to construct the 16PF. Very little evidence regarding Cattell's views in general, and the 16PF in particular, is seen to be ambiguous. Investigations either support him unequivocally or they find practically no value in the results of his vast research programme. There seems to be no middle ground. Invariably the camps are composed of Cattell's students and colleagues on one hand, and almost everyone else on the other. This polarisation seems due in good part to Cattell the man; as Berg (1967) states:

Cattell has little patience with soft-headed psychologists, whom he has characterised as refugees from the natural sciences; he has persisted in recasting everything from personality traits to psychometric theory into his own system, with its particular esoteric vocabulary; and he is generally argumentative and critical of the work of other

psychologists, especially those who do not support his views. (p. xi).

Of course, Cattell's own contributions are voluminous and he ranks with his chief competitors, Guilford and Eysenck, as one of the most productive psychometric researchers in this area of specialisation.

Aim

The purpose of this article is to review and summarise the available evidence and opinions surrounding the factor theory of personality with particular emphasis on Cattell's 16PF in an attempt to ascertain its predictive validity as a measurement of personality.

Literature Review

Number of Factors in the Personality Sphere

There is a continuing controversy over the appropriate number of personality factors. Different theorists and researchers (Eysenck and Eysenck, 1969), have proposed differing numbers of factors as being necessary and sufficient to describe normal personality. New personality factors and scales to measure them are continually being proposed (Mershon and Gorsuch, 1986). Attempts to integrate and amalgamate the new factors with existing factors are rare, although inspection and factor description suggest many factors in different systems differ in name only. In clinical as well as research areas, the lack of agreed-upon personality factors is a handicap. Mershon and Gorsuch (1986), strongly state that what is needed is maximum useful information, where uselessly specific data on one hand and overly general information on the other hand can be avoided. Researchers engaged in the question of the number of factors in the personality sphere seem to be divided into roughly three positions: Two factors, five-to-eight factors and 13-to-18 factors.

The Two-Factor Position. Peterson (1965) and Eysenck (1971) are two major critics of Cattell's 16 Personality Factor system, maintaining that there are only two normal personality factors worth study. Furthermore, they advocate virtually the same two factors but under different names. The two factors Peterson (1965) proposed were Introversion-Extraversion and Adjustment. In developing his rationale for two factors of personality, Peterson (1965) discussed reductionism, choice of factor level, "descriptive efficiency" of factors and factor invariance as criteria for factor selection. These criteria are primarily based on factor analytic theory. According to Peterson (1965), reductionism was a major advantage of a two-factor system of personality; he argued that when people talk about personality, their statements are general and revolve around global concepts or categories such as introversion-extraversion and adjustment. He cited Wetzel's 1963 study in which subjects, peers and parents provided ratings on introversion-extraversion and adjustment and these ratings were then correlated with the subjects' corresponding second-order factor scores on the 16PF (Cattell, Eber and Tatsuoka, 1980). The

correlation of Introversion-Extraversion with Cattell's Exvia was $r=.61$ and of Adjustment with Cattell's Anxiety was $r=.45$. Peterson concluded Wetzel's subjects' ratings were organising information similarly to that in the 16 PF, but more simply.

In his discussion of the generality and scope of personality factors, Peterson (1965) believed the choice of factor level was an important consideration. Factors vary in complexity. The area of human abilities illustrates broad and narrow factors. Spearman (1904) investigated the very broad general intelligence factor. Thurstone (1938) broke this broad factor down into seven to nine primary mental abilities. Continuing the process of identifying and specifying factors more precisely, Guilford (1975) identified thirteen intelligence factors. Generally, narrow factors can be subsumed under a broader factor; broad factors can be split into narrower factors. In a given situation, "the process has to stop when a single general factor emerges at the top of the hierarchy, and instrumental specifics appear at the bottom" (Peterson 1965, p. 48), or when orthogonal factors appear. Another way to describe a "narrow" factor is as a primary or first-order factor, and another way to describe a "broad" factor is as a second- or third- or more-order factor. It was Peterson's contention that two broad factors, Introversion-Extraversion and Adjustment, summarised available data in an informative yet concise way. He believes a broader factor would blur description by being too general, and narrower, or lower-order factors would confuse by providing too much specific information.

Descriptive efficiency was another major criterion for factor analysis cited by Peterson (1965). Examination of variance plots of actual studies, in which magnitude of the variance is plotted against successive factors, Peterson argued, shows that after the first two or three factors are extracted, there is little variance remaining. He believes that factors extracted after the crucial first few have little descriptive power, and are therefore inefficient according to Peterson's use of the descriptive efficiency criterion. This also supports Peterson's use of two factors to describe personality.

Another of Peterson's (1965) factor analytic criteria was factor invariance. "Invariance" refers to the constancy of factor content from one analysis to the next. Where a factor for numerical skill, for instance, appears, this should be regularly in evidence whenever the same or a similar test battery is used with samples of the same population. Using Cattell's data, Peterson (1965) concluded that the 16PF factors are very weak when examined from the standpoint of this criterion. Peterson then tested the invariance of the two 16PF higher-order factors which he labelled "Introversion-Extraversion" and "Adjustment". These two factors were quite invariant, and therefore preferable, according to Peterson.

Virtually synonymous with Peterson's Introversion-Extraversion and Adjustment respectively are the two factors advanced by Eysenck & Eysenck (1969) as necessary and adequate in describing personality, namely Extraversion and Neuroticism. Eysenck (1971) maintained that the 16PF, rather than measuring 16 primary factors as claimed, (Cattell, Eber and Tatsuoka, 1980), measures two. He based his claim on the fact that the five 16PF factor scores measuring extraversion correlate highly, and

likewise the five 16PF factor scores measuring neuroticism correlate very highly. From this he concluded that the 16PF measures only two factors, and the test items which make up the other six factors were otherwise allocated on a completely random basis to the Cattell factors. Eysenck, White and Souseif (1969) separately factor analysed approximately 100 items from the Guilford, Cattell and Eysenck questionnaires. There are considerable similarities between the personality descriptions given by the factor-analysis based systems of Cattell, Guilford and Eysenck; these similarities, however, appear only in the higher-order factors called Extraversion-Introversion and Neuroticism-Stability by Eysenck, and Extraversion and Adjustment-Anxiety by Cattell. While the factors extracted at this level from sets of questions contributed by these three authors are virtually identical, there is little agreement on primary factors. The implication is that certain 16PF scales can be dropped without loss of any essential information. Yet Cattell is quite specific in his claims:

The primary factors give one most information and we would advocate higher strata contributors only as supplementary concepts..... It is a mistake, generally to work at the secondary level only, for one certainly loses a lot of valuable information present initially at the primary level, (Cattell, Eber and Tatsuoka, 1980, p.111).

Eysenck's position is equally clear, maintaining that second-order factors are far more meaningful psychologically (Eysenck, 1967).

As Eysenck and Eysenck (1969) have pointed out, higher-order factors show considerable agreement between the two models. As the same reference explains, Eysenck believes that the distinction between primaries and higher-order or superfactors is useful, although the allocation of a factor to a particular order (first, second or third, etc) is not. This distinction between primary and higher order factors is loosely tied up with his distinction between 'T' and 'C' factors, that is, tautological factors (primary) and complex factors (higher order), which combine several different primaries on the basis of their intercorrelations. Psychologically, Eysenck believes tautological factors are of less interest than are complex factors, if only because logically the items in T factors are connected through similarity; the discovery of such a factor is hardly surprising and any number of such factors could be artificially created by simply rewriting a particular questionnaire item in several slightly different ways. C factors are made up of dissimilar items, ie of items where the finding of a correlation does not involve a tautology; sensitivity and nervousness are examples of factors some way towards the C end of the continuum. Such factors are usually less easy to identify and name, and some subjectivity is attached to such efforts, however, Eysenck believes them to be much more interesting psychologically.

Comrey and Duffy (1968) administered the Eysenck Personality Inventory, the Cattell 16PF and the Comrey Personality Inventory to 272 volunteers. In developing his personality system, Comrey worked with Factored Homogeneous Item Dimensions (FHID) which consist of items written to measure a specific factor and which have been shown to do so by factor analysis. Eysenck and Cattell's factor scores were correlated with scores over homogeneous item groups which define the Comrey test factors. This

matrix was factor analysed to relate the Eysenck and Cattell factor scores to the factor structure underlying the Comrey test. The Eysenck Neuroticism, Comrey N, and Cattell's second-order Anxiety factors appeared to match. The Eysenck Introversion and the Comrey Shyness factors also matched. The 16 Cattell primary factors overlapped but did not match with the Comrey factors. To the extent that the respective factors occupy the same space, that is the same hyperplane, the question arises as to which set is to be considered more useful and meaningful psychologically, the Cattell factors or the Comrey factors. The answer to this question no doubt depends on one's orientation and purposes. Referring to Levonian (1961), considerable heterogeneity of content of items appears on the Cattell factors. The Comrey factors, on the other hand, are defined by substantially correlated F11Ds, which in turn consist of items which are homogeneous, both with respect to apparent content and inter-item correlations. The items defining a Comrey factor therefore exhibit greater homogeneity than those of the Cattell factors. Although these facts do not prove it, they suggest that the Comrey factors are more unitary than the Cattell factors. If the relatively uncorrelated items on the Cattell factors in fact define unitary factors, item statistics should be published which demonstrate this. Cattell has published a diagram (Cattell and Tsujioka, 1964) showing how it is theoretically possible for two uncorrelated items to measure the same unitary factor, but he has not published item data which show that the bulk of his items do in fact constitute actual examples of such a phenomenon.

Another critical investigation of the 16PF was the item factor analysis reported by Howarth and Browne (1971). With a Canadian sample they found ten out of eighteen factors rotated could be interpreted and, of these, half could be regarded as having similar significance to the 16PF factors when studied in a 10-factor Varimax rotation. Of the 34 high loadings on these factors, 18 belong to the appropriate individual 16PF factors. Five factors have no representation at all, and the remaining few have little or doubtful relation. The authors concluded that ".....Cattell's questionnaire factor system has been developed on the basis of inadequate investigation of primary factors...." (p. 138). Eysenck (1971) seized upon these results and strongly stated conclusions of Howarth and Browne's study and used them as a basis for a broad denunciation of the 16PF, including criticisms of the Minnesota Multiphasic Personality Inventory (MMPI) and other competitors of his own Eysenck Personality Inventory (EPI) for good measure. Regarding the 16PF, he concluded that "..... the investigator using this scale is in fact getting sixteen measures of doubtful meaningfulness, and which are almost certainly non-univocal...." (p. 88).

Adcock and Adcock (1977) analysed a large sample of New Zealand subjects in order to provide further evidence with regard to the validity of the 16PF (Form A). Eighteen factors suggested by the Scree Test were rotated to oblique simple structure and matched as in the 1972 Cattell paper. In some cases the match was better than that obtained by Cattell, but no match can be found for N or M, while nine Q4 variables, nine from C and five from O come together to define the best represented factor, which is clearly general emotionality or anxiety. A separate C factor did, however, appear. While confirming the general factorial structure of the 16PF this study suggests that for this New Zealand sample it is not an

adequate measuring instrument in its present form. In a cross-cultural context there seems to be a challenge to the reliability of the 16PF structure across populations. Citing German and British (Seville and Blinkhorn, 1976) studies, Eysenck (1982) stated: "Replications of Cattell's factor analytic studies in different countries have usually failed to produce factors even reasonably similar to his American solutions." (p. 239).

These areas of controversy have resulted in confusion to adequately assess the 16PF after 34 years of use. This indicates the need for further application and analysis on the broadest scale possible, so that some idea of the replicability and invariance of factors may be obtained. Cross-cultural studies should constitute a vital part of such work. In attempting this, Abdel-Khalek, Abdel-Satter and Budek (1986) performed a study to determine the factorial structure of the 16PF in two Egyptian samples of male and female university students in an attempt to test the replicability of Cattell's 16PF with Egyptian subjects. In their study they decided to administer the 16PF in addition to a less factorially complicated inventory, the Eysenck Personality Questionnaire, (EPQ), (Eysenck and Eysenck, 1975). The EPQ with its broader dimensions was used as a set of markers leading toward a better interpretation of the factor resolution of the 16PF in Egyptian subjects. The factorial analysis of the intercorrelations between the subscales of the 16PF in this study did not reveal more than two significant factors. These corresponded to Eysenck's Neuroticism and Extraversion which in turn correspond to the first two of Cattell's (1967) second-order factors, ie Anxiety and Excitement. The results of this study are congruent, either totally or partially, with previous work done by other investigators (Costa and McCrae, 1976). It seems most research studies are only emphatic about two of the factors in the 16PF albeit second-order factors, yet Cattell (1972) insists that the dependence on the second order factors is a relatively inefficient procedure because, he believes, some information will certainly be missed. Prediction, he suggests, cannot be carried out using second-order factors to the same extent as with first-order factors. Nevertheless, the concepts of replicability and invariance of factors are highly relevant to the validity of any given theory or test of personality. This replicability of factors, their invariance when sample parameters change, is a basic requirement for any reliable and valid measurement of personality. Cattell's argument in favour of the definition and use of the primary source traits of personality structure is weakened by lack of agreement as to their invariance, replicability and generalizability. The primary factors which have been unearthed and used in personality research, such as Cattell's factors, fail because they are in fact not unitary, univocal combinations of items measuring the same fundamental trait, as is assumed by Cattell; they are not invariant across such differences as sex, age or education. Instead, Eysenck and Eysenck (1969) suggests that they appear to be half arbitrary, half accidental conglomerations of items sharing functional equivalence only to a limited degree.

Five-to-Eight Factor Position. It is evident that the task of primary factor extraction is not nearing completion as some writers claim. In fact it has hardly begun. Proponents of a five-to-eight factor position include Norman (1963), McCrae and Costa (1985), Howarth (1976), Conrey (1973) and Becker (1961). Each researcher factor analysed one or

more major data pools and concluded that five-to-eight factors were necessary and sufficient to describe personality, as opposed to Cattell's 16. Their factors included Extraversion and Anxiety but these two were not sufficient in their view. Following the lead of Allport and Odbert (1936) and of Cattell (1946), Norman (1963) assumed that "natural languages such as English would have evolved terms for all fundamental individual differences. An analysis of language would, therefore, provide a comprehensive model of personality traits", (McCrae and Costa, 1985, p. 710). Norman used peer nomination rating methods similar to Cattell's (1947) and found only five factors in his factor analysis. McCrae and Costa (1985) examined the Norman factors; they proposed changes in interpretation of two factors, but also recommended the use of five. Howarth (1976) rotated Cattell's (1947) unrotated factor matrix and tried 10, seven and five factor solutions. He concluded that a seven factor solution was the best and that Cattell had overfactored. Another approach using five-to-eight factors was taken by Digman and Takemoto-Chock (1981). They re-analysed eight sets of data from Cattell, Digman, Fiske, Norman and Tupes and Christal. Digman and Takemoto-Chock's purpose was to determine how many factors would be found if the identical model of factor analysis and the identical rotation method were used in analysing all the studies. In all cases five-to-eight factor solutions were preferred. It was concluded that:

The number of factors involved in these studies is an interesting number and suggests the psychological processes which are involved in the rating of personality characteristics....various considerations of the encoding, storage, and retrieval processes in memory are involved. The number five, perhaps even seven as the upper limit, probably represents limits on human information processing (Digman and Takemoto-Chock, 1981, p.165).

In developing his personality factor system, Comrey (1973) worked with FHDs. These FHDs are somewhat analogous to Cattell's "parcels" of items. Comrey does not directly factor the items, but factors the FHDs. He reports eight factors for personality. As can be seen from Table 1, the five-to-eight factors arrived at by different researchers are quite similar. It is interesting to note that factors aside from Extraversion and Anxiety come up almost as frequently as these two factors on the various researchers' list. One such factor is Agreeableness (Norman)/ Cooperativeness (Howarth)/ Compliance (Digman and Takemoto-Chock). Another common factor is Conscientiousness (Norman; McCrae and Costa)/ Superego (Howarth)/ Will to Achieve (Digman and Takemoto-Chock). This similarity of five-to-eight factors tends to provide further support for the more than two factor position.

Further support for the five-to-eight factor position was provided by Becker (1961) who factored the 16PF and concluded that ".....at best the 16PF is measuring only eight factors.....that is not to imply that there may not be more factors than eight in the personality questionnaire domain, but rather that, if they exist, they have not been measured with sufficient reliability or independence for related factors to be revealed by the tests as presently scored". (p.402).

Inspection of Table 1 strongly suggests the consensus of factors found by diverse investigators using widely varying techniques and samples. Norman, McCrae and Costa, Howarth, Digman and Takemoto-Chock, Comrey, and Becker, all concluded that five-to-eight factors described their data. Thus they hold that Peterson and Eysenck had too few factors. A five-to-eight factor personality system, according to Digman and Takemoto-Chock (1981), may be most commonly found because that is how people think. They believe that this is another example of the seven plus/minus two rule regarding processing bits of information.

Other researchers (Goldberg, 1982; Peabody, 1984) have chiefly been concerned with the representativeness and comprehensiveness of the five-factor model with respect to the natural language of traits, and others have sought to provide a theoretical basis for the taxonomy (Hogan, 1983). McCrae and Costa's (1987) major concern has been the convergent and discriminant validity of the dimensions of the five-factor model across instruments and observers. If the five-factor model is a reasonable representation of human personality, it should be recoverable from questionnaires as well as from adjectives and from observer ratings as well as from self-reports. This line of research addresses substantive questions from the methodological perspective developed in the past few years. One of the strongest arguments in favour of the five-factor model has been its appearance in both self-reports and ratings. Norman (1963) reported the structure in peer ratings. Goldberg (1982) showed parallel structures in both ratings and self-reports. As early as the 1960's, convergence across observers was also demonstrated (Borgatta, 1964). However, with a few exceptions, these studies used only adjective-rating scales and few attempts were made to compare adjective factors with standardised questionnaires that are more widely used in personality research.

In a recent publication McCrae and Costa (1985) examined the correspondence between adjective and questionnaire formats to see if the same substantive dimensions of personality would be obtained in each. The adjective-rating instrument was an extension of one devised by Goldberg (1982); the questionnaire was the Neuroticism, Extraversion and Openness to Experience (NEO) Inventory (McCrae and Costa, 1983), which measures three broad dimensions identified in analyses of standard personality measures. Self-reports on five adjective factors were compared with both self-reports and spouse ratings on the inventory dimensions of neuroticism, extraversion and openness to experience. In brief, the study showed that a version of the five-factor model could be recovered from the adjectives; that there were clear correspondences for neuroticism and extraversion dimensions across the two instruments; and that validity coefficients above .50 could be obtained with both self-reports and spouse ratings.

From the reviews above it is evident that from time to time the charge has arisen that the number of factors in the 16PF and, by implication, in other tests in the 16PF series, is not sixteen. Researchers such as Comrey and Duffy (1968), Eysenck (1972), Guilford (1975), and Howarth and Browne (1971) have concluded that fewer factors adequately explain the covariation among the primary scales of the 16PF. But they have represented a broad range of opinion as to what the number should be. If the charge is true, then the implication is that certain

Table 1

Five-to-eight Factor Equivalence Table

NORMAN	MCCRAE & COSTA	HOARHORN	DIGMAN & TAKEMOTO-CHOCK	COTTERY	CATELL
<u>Extraversion</u>	<u>Extraversion</u>	<u>Extraversion/</u> <u>Sociability</u>	<u>Extraversion</u>	<u>Extraversion</u>	<u>Extraversion</u>
Talkative, frank, adventurous, sociable	Talkative, frank, adventurous, sociable	Gregarious, frank, expressive	Gregarious, energetic, happy, outspoken	Energy, not reserved, not exclusive, not shy	Unshamed, assertive, happy-go-lucky, venturesome
<u>Emotional Instability</u>	<u>Neuroticism</u>	<u>Adjustment/</u> <u>Emotionality</u>	<u>Emotional Disorganisation</u>	<u>Neuroticism</u>	<u>Anxiety</u>
Nervous, anxious, excitable, hypochondriacal	Nervous, anxious, excitable, hypochondriacal	Anxious, neurotic fatigue, easily upset, hypochondriacal	Emotional disturbance, lacking ego defence mechanism	Depression, pessimism, moodiness, agitated,	affected by feeling, tense, suspicious, apprehensive
<u>Agreeableness</u>	<u>Agreeableness</u>	<u>Cooperativeness/</u> <u>Conscientiousness</u>	<u>Friendly-Compliance</u>	<u>Social Conformity</u>	<u>Contentia</u>
Good natured, not jealous, gentle, cooperative	Good natured, not jealous, gentle, cooperative	Submissive, good natured, not jealous, kindly	Cooperative, ready to help, caring, submissive	Acceptance of social order, unselfishness, seeks approval	Unshamed, tender-minded, imaginative, trusting
<u>Conscientiousness</u>	<u>Conscientiousness</u>	<u>Superego</u>	<u>Will to Achieve</u>	<u>Orderliness</u>	<u>Superero</u>
Tidy, responsible, scrupulous, persevering	Tidy, responsible, scrupulous, persevering	Responsible, persevering conventional, conscientious, persevering	Planfulness, purposefulness, persistence, striving	Meticulous, cautious, organised, follows routine	Strenuous
<u>Culture</u>	<u>Open to Experience</u>	<u>Intellect</u>	<u>Intellect</u>	<u>Activity</u>	<u>Intelligent</u>
Artistically sensitive, intellectual, polished, imaginative	Original, imaginative, creative, broad interests	Polished, composed, aesthetic and musical tastes, imaginative	Polished, composed, aesthetic and musical tastes, imaginative	Energy, endurance, works hard, strives to excel	Abstract thinking bright, high scholarly mental capacity
<u>Surgency</u>	<u>Surgeon</u>	<u>Surgeon</u>	<u>Surgeon</u>	<u>Trust</u>	<u>Masculinity</u>
	Energetic, talkative, cheerful, emotional	Energetic, talkative, cheerful, emotional	Energetic, talkative, cheerful, emotional	Lack of cynicism, defensiveness	Tough-minded, not bothered by: blood, crawling creatures
Source: Harsthorn & Gorsuch, 1986.					

16PF scales can be dropped without loss of any essential information. Cattell's (1972) position is unyielding, stating that the number of primaries encapsulated in the 16PF series is no fewer than the stated number. In an attempt to support the premise that the number of dimensions in the 16PF is indeed 16, Cattell and Krug (1986) presented evidence from two independent approaches and more than 50 separate studies.

Cattell's 16PF. There are many reasons for disagreements among researchers regarding the number of dimensions underlying the 16PF, and Cattell and Krug (1986) believe two are paramount; (a) differences in breadth of variable sampling, and (b) inconsistencies in applying a correct, objective test for the number of factors among factor analysts. Before a presentation of the evidence for the dimensionality of the 16PF is described, a brief review of these two issues is necessary.

At one level, factor analysis can correctly be understood as nothing more than a reductive technique that transforms one set of observations to a smaller set of reference axes. At this simple level of application, there is no reason to presume that the resulting components represent either primary personality characteristics or underlying behaviour dimensions. But when factor analysis is applied to a well-defined, carefully stratified, and properly sampled data set and when experimental results are subjected to independent reconfirmation over observational facets, over cultures, and over experimenters, then, Cattell and Krug (1986) believe that the factors one extracts from data matrices begin to correspond to important psychological constructs. In short, Cattell and Krug are suggesting that it is not the application of factor analysis alone that results in source traits, but the application of factor analysis within a rigorous and comprehensive programme of scientific experimentation that does so. They stress that one cannot factor analyse just any data set and argue convincingly that the results truly reflect the dimensionality or structure of human personality.

In the case of the 16PF, the original sampling of variables was drawn from the total universe of personality description - the personality sphere (Cattell, 1972). The first analyses were exploratory, hypothesis-generating studies. They were not guided or limited by preconceived notions about the structure of personality. Although many of the factors that were found bore some resemblance to concepts proposed by earlier theorists (for example, Kretcher's cyclothymic vs schizothymic dichotomy in what Cattell's researchers indexed as Factor A, Freud's ego strength in Factor C), Cattell believes that many were new concepts that had, at least in their pure state, formerly eluded personality theorists (Cattell, 1973).

Other theorists began from a different perspective. Guilford and his associates sought hypothesised components of introversion-extraversion (Guilford, 1975). Eysenck (1972) started with items taken from the Guilford inventories, and Conrey (Conrey and Duffy, 1968) began by analysing items in the MMPI. In each case, Cattell insists that the variable definition procedure resulted in a more limited sampling than that afforded by the total personality sphere concept in which the 16PF was rooted, therefore suggesting that it is not surprising that other researchers should conclude that fewer dimensions need to be considered (Cattell and Krug, 1986).

If the difference with regard to variable sampling is a source of many disagreements, Cattell suggests that the failure of many factor analysts to apply correct objective tests of the number of factors may represent an even more significant impediment to consensus. Smith and Vetter (1982) recognised this issue as a serious problem, asking "When different factor analyses involve basically the same set of variables, should they not isolate at least the same number of factors in various studies ?" (p. 304). To this question Cattell gives an emphatic affirmative.

Cattell's unfailing ability to adduce support for the primary dimensions of his personality sphere is nowhere more apparent than in his re-analysis of 69 Cattell and Guilford parcels that originated in a dissertation project by one of Guilford's students (Cattell and Gibbons, 1968). While the original Varimax solution was more consistent with Guilford's system (Gibbons, 1966) the results of Cattell's re-analysis confirmed all 14 of the 16PF factors represented in the data set. It should be noted, however, that Gibbons did not concur in this conclusion: he is quoted by Howarth & Browne (1971) as follows, "I have tried to interpret the results from the Cattell-Gibbons oblique rotation and have failed to get a meaningful interpretation". Two of Cattell's students, Bundsal and Vaughn (1974) concluded that the results of their item factor analysis of the 16PF "..... was essentially the expected factor pattern. The study did, however, indicate that four of the sixteen factors (G, M, N, Q1) were probably in need of revision and further research (p. 223)".

It is obvious that the controversy over the number of factors in the personality sphere is continuing. In fact, Cattell (1957) suggests that in a clinical sense there are a further seven factors of small variance and rather unstable reappearance, and with one exception, Cattell suggests that these also appear 'normal', and a part of his total personality sphere. Thus, what a clinician recognises as abnormal can be either a statistically deviant score on a normal factor, or, alternatively, a score on some factor the very existence of which is demonstrable only in pathological investigations, as is recognised on some MMPI scales. In a study by Cattell and Bolton (1969) a set of mutually exclusive exhaustive parcels of MMPI items and the 16 personality factor scales from the Cattell 16PF were factored together on 217 normal and 40 abnormal adult Air Force men. This study found that some MMPI scale scores, notably schizophrenia, anxiety, psychasthenia and social introversion can be predicted with appreciable efficiency from the 16PF. A result by Eber (1966) independently supports these conclusions. The results are also consistent with the findings that the directions in which the 16PF have been found most potent in clinical practice (Cattell and Scheier, 1961; Cattell, Tatro and Komlos, 1964) are those of neuroticism (including anxiety), psychasthenia and the separation of the schizophrenias. The converse prediction, that is, MMPI to 16PF scales was not possible.

Validity of Test Measurement

It has been demonstrated that the controversy over the number of factors in the personality sphere is continuing. The studies reviewed up to this point have used factor analytic theory and technology to argue their respective positions. In compiling such a review, mention must be

made of the notion of the validity of the test measurement and the misunderstandings associated with it.

The validity of a test concerns what the test measures and how well it does so (Anastasi, 1982). Fundamentally, all procedures for determining test validity are concerned with the relationships between performance on the test and other independently observable facts about behaviour characteristics under consideration, that is, a test's validity must be determined with reference to the particular use for which the test is being considered. In the American Psychological Association's publication "Standards for Educational and Psychological Tests and Manuals" (1985) the procedures for determining test validity are classified under three principle categories: content, criterion-related and construct validity.

Content validity essentially involves the systematic examination of the test content to determine whether it covers a representative sample of the behaviour domain to be measured (Anastasi, 1982). Thus, content validity is built into a test from the outset through the choice of appropriate items. It might thus appear that mere inspection of the content of the test should suffice to establish its validity for such a purpose. This solution is not as simple as it appears to be. One difficulty is that of adequately sampling the item universe. The behaviour domain to be tested must be systematically analysed to make certain that all major aspects are covered by the test items and in the correct proportions. This does create some misunderstandings within the personality field as is evidenced by the different sampling of variables. Mention has already been made of the different sampling variables concerning Cattell, Eysenck and Guilford, a reason Cattell believes that the other researchers conclude that fewer dimensions need to be considered.

Criterion-related validity indicates the effectiveness of a test in predicting an individual's behaviour in specified situations. For this purpose, performance on a test is checked against a "criterion", ie a direct and independent measure of that which the test is designed to predict. The criterion measure against which test scores are validated may be obtained at approximately the same time as the test scores or after a stated interval (Anastasi, 1982). The American Psychological Association's test "Standards" (1985) differentiate between concurrent and predictive validity on the basis of these time relations between criterion and test. The term "prediction" can be used in the broader sense, to refer to prediction from the test to any criterion situation, or in the more limited sense, of prediction over a time interval. It is in the latter sense that it is used in the expression "predictive ability". The information provided by predictive ability is most relevant to tests used in the selection and classification of personnel.

The construct validity of a test is the extent to which the test may be said to measure a theoretical construct or trait (Wallen, 1956). Focussing on a broader, more enduring and more abstract kind of behavioural description than the previously discussed types of validity, construct-validation requires the gradual accumulation of information from a variety of sources. Any data throwing light on the nature of the trait under consideration and the conditions affecting its development and

manifestations are vital for this validity. In a thoughtful analysis of construct validation, Campbell (1960) points out that in order to demonstrate construct validity it must be shown not only that a test correlates highly with other variables with which it should theoretically correlate, but also that it does not correlate significantly with variables from which it should differ. In an earlier article, Campbell and Fiske (1959) described the former process as convergent validation and the latter as discriminant validation. Discriminant validation is especially relevant to the validation of personality tests in which irrelevant variables may affect scores in a variety of ways.

Validity of the 16PF

Fox, Nabouha and Dinur (1981) examined the validity of the 16PF as a predictor of the success of female military officers. Three independent criteria were measured:

- a. officers' ratings;
- b. peer nominations; and
- c. final course grades.

The results showed that factors E, H, L, M, N, Q1, Q2 and Q3 of the 16PF were correlated significantly with at least one of the criteria. Although the findings generally supported the interpretation of many of the 16PF scales, as rendered by Cattell, Eber and Tatsuoka (1980), the outcomes suggested an alternative interpretation of Factor M. Factors E and M stood out as statistically significant predictors of most criteria. Factor E was strongly correlated with the officers' ratings of self-confidence and significantly correlated with peer nomination as well as with success in officer school. Factor M was also related to Characteristic A of the peer nomination scores, assessed by self-confidence and success in the course. Factors C, H, L, N, Q1, Q2 and Q3 were associated significantly with at least one of the criterion measures, and Factors F, G, I, O and Q4 were not related to any one of the criterion variables.

The most striking aspect of the results is that each of the components of Cattell's QIV second stratum factors (Cattell, Eber and Tatsuoka, 1980) was significantly correlated with at least one of the criterion measures. This broad factor, composed of the E, L, M, Q1 and Q2 scales, was interpreted as reflecting a subduedness-independence continuum. A person high on this factor is described by Cattell as "independent, radical, autistic, projective and a law to himself" and as having "a general temperamental independence in the broadest sense" (p. 119). Since both the officers' course and the assessment-centre activities which preceded it are leadership programs, it follows that characteristics such as assertiveness, self-confidence and independence could have affected the manner in which candidates were viewed and evaluated by their peers and superiors.

If one turns attention to the particular source traits composing this second-stratum factor, it is apparent that Factor E received the strongest support for the interpretation given to it by Cattell. The low

correlations of Factor E with "Cooperation" and "Responsibility" scores suggest the existence of convergent and discriminant validities of the factor (Campbell and Fiske, 1959) and thus strengthens Cattell's interpretation of it. In sum, this study generally supported the construct validity of second-order factor Q1V. Fox, Haboucha and Dimir (1981) also suggest that Cattell's interpretation of scales E, H, L, Q1 and Q2 seems plausible. In addition, it is suggested that these findings offer evidence that the 16PF can be of practical value in applied contexts.

Saville and Munroe (1987), however, question the reliability of the 16PF. Fundamentally, if a measure is unreliable, no matter how well accepted it is, or how much confidence users have in it, it cannot possess much validity, since its reliability sets a ceiling on the amount of validity it can have. Reliability, of course, cannot imply validity, but without reliability there can be no validity. If the 16PF, therefore, has unreliable scales, that is, if they are made up of random error variance or noise, the use of the 16PF must be questioned. Saville and Munroe (1987) reported the alternate form reliabilities of the 16PF. The alternate form reliability coefficients indicate the extent to which two different forms or editions of the same test measure the same characteristic. For scales to be psychometrically acceptable the coefficients are expected to be about 0.6 or more. Lower values than this mean wide bands of error indicating tests should not be used for individual decision making. For the 16PF, Saville and Munroe (1987) report that the reliability coefficients of its scales fall within the range, 0.25 to 0.73, with a median around 0.5. Some 12 out of the 16 scales of the 16PF fail to reach an alternate form reliability of 0.6; six are as low as 0.4 or less. In fact, Saville and Munroe (1987) state that many 16PF scales (B, G, L, M, N, Q and Q2) simply fail to come up to conventional standards of reliability. They ask, where, for example, would a person fall on taking Form B of the 16PF if they were average on Form A? In fact, on Factor N, Saville and Munroe (1987) suggest that a tolerance of plus or minus 3.46 stens is needed for 95% confidence. That is, a band covering the complete range from the second to the ninth sten.

Boyle (1988) is quite emphatic with his claims that reliability is not an issue with the 16PF. He states, "the reliability of the 16PF can be improved to any extent desired by having the applicant complete additional forms of the questionnaire. Reliability is NOT an issue with the 16PF, since use of more than a single form results in quite reliable profiles" (p. 11). Cattell (1973) has always advocated the use of combined forms, believing the use of parallel forms increases the reliability by doubling the numbers of items administered. Boyle (1988) chooses to use the qualifier "quite" when referring to the reliability of the 16PF after the use of more than one form of the 16PF. "Quite" is an ambiguous adverb, where the colloquial use suggests uncertainty. Should Boyle have been using the word advisedly, how many forms of the 16PF are needed to confirm its reliability? Also, why are short versions of the 16PF, of debatable reliability, readily available and widely used?

It is clear from the research done on the definition and measurement of personality that there is still considerable controversy as to the number of factors required to adequately describe human personality. Curiously, even the EPI can be used to make a case for the 13-to-18 factor

position. Fifteen factors have been extracted from the EPI by Howarth and Browne (1972). They actually concluded that the EPI should be scored for primary factor scales in order to present a more detailed picture of extraversion and neuroticism. Eysenck himself (Eysenck and Eysenck, 1969) extracted 12 factors from the EPI, but continues to advocate that only the two higher-order factors are useful and replicable.

The majority of studies reviewed here have used factor analytic theory and technology to argue their respective positions, yet factor analytic approaches really have not been convincing as it seems different numbers of factors can be extracted for different purposes. Cattell, Guilford, and Howarth and Browne firmly maintain that 13-to-18 factors are present in and necessary to describe personality. Proponents of both the two factor and the five-to-eight factor position would argue that this is overfactoring, therefore unnecessary and meaningless. However, even more than 18 factors have been suggested. Cattell concluded that 23 factors are necessary to describe normal adult personality (Cattell, 1973). So, it seems, 18 is not the upper limit of those proposed, and the controversy over the number of factors in the personality sphere continues.

In reviewing the data on the 16PF, there is little doubt that significant contributions to the factor theory of personality, both conceptually and technically, have been made by Cattell. However, there is considerable doubt about the construct validity of the 16PF. This doubt involves both its convergent and its discriminant validity. Although the 16PF purports to measure 16 distinct personality traits there is no evidence of the convergent validity of the 16 scales apart from factor loadings, and what evidence there is of discriminant validity suggests that the primary traits are not clearly differentiated. When coupled with the relatively low internal consistency of the scales and their modest test-retest reliabilities, the psychometric adequacy of the test must be questioned.

AA Psych Corps' Use of the 16PF

The AA Psych Corps introduced the 1967 revised version of the 16PF as its principal measure of personality functioning (DPSYCH-A, 1985). The Australian Army requires that an assessment of personality be made by a psychologist before soldiers can be selected for certain specialist categories of employment, as well as service for the Antarctic. However, as suggested by Warn (1986), no interpretative guidelines were offered to Army psychologists tasked with selection, except that attention was drawn to the Handbook for the 16PF (Cattell, Eber and Tatsuoka, 1980). This omission is of some concern especially in view of the fact that Army psychologists do not necessarily receive formal training in the use of the 16PF as part of their supervision. For this purpose, Warn (1986) proposed a method by which psychologists can use the 16PF to assist in assessment of an applicant. In doing this he referred to a type placement approach where the psychologist compares an applicant's scores on the primary factors to the means for the group for which entry is being considered. For instance, if the applicant wished to join the Military Police, his scores on each factor would be contrasted with those for the group of current (and perhaps past) military police. One drawback of the type placement approach is that standards of performance are not considered. The criterion being used is

simply membership of a special group by having passed a course to qualify. To continue the example, the type placement approach would fail to acknowledge that some military police might perform better than others, either in training or in later service.

Warn (1986) suggests a performance approach would overcome the above objection by contrasting the applicant's scores against those of the subgroup who have displayed some degree of excellence. The contribution of each factor of the 16PF towards this superior performance is indicated by its weight on a specification equation. After entering individual factor scores into the specification equation, the psychologist obtains a score that indicates the extent to which the applicant approximates the criterion group. An example of a specification formula for a group is provided in the 16PF Handbook for success as a patrolman. Patrolman Success = $-.47A - .35F - .35L + .23Q2 + .23Q3 + 9.41$ (Cattell, Eber and Tatsuoka, 1980, p.165). However, the psychologist would require a valid and measurable criterion of superior performance before the performance approach could be effective.

The type placement and performance approaches are both recommended by Cattell and Krug (1986), who believe that the occupational psychologist would do well to build up a file on the sample group. Not only would the measures of the local sample increase the validity of the comparisons between group and individual applicant but Cattell also sees such research as necessary for the compilation of more universal norms.

The advantage of using the statistical approach outlined above is that the psychologist need not rely on guesswork in order to determine the relative significance of individual factor scores. Another statistical method is the use of cut-off or critical scores on relevant factors. For example, a psychologist might find that a low score on factor G is predictive of problems and consequently decide that any applicant scoring below the cut-off is to be screened out (Cronbach, 1970). Alternatively, specific hypotheses might be generated for a structured interview where each can be evaluated by integrating real life content with the 16PF psychometric findings (Cattell's depth psychometry approach (Cattell, 1983)).

The Army psychologist is provided with none of these statistical tools and thus there is a requirement for a more interpretative approach involving an analysis of the underlying dynamics of the factors. Warn (1986) outlines such a method suggesting that the interpretative method can be regarded as complementary to the statistical. By adopting an interpretative as distinct from statistical method the psychologist is able to search the primary factors for an individual pattern, yet this still leans on the insight of the individual psychologist.

Warn (1986) offers a routine approach to the Army psychologist for the interpretation of the 16PF. In brief, Warn suggests:

- a. the psychologist needs to make a note on the level of distortion that is suggested by the faking or MD sten; and
- b. the second order factors need to be examined since it is from these that the psychologist can begin to hypothesise about the

applicant's personality. Once a summary description has been formulated, the individual complexities of each second order factor can be explored by examining their primary factor composition.

At this point, Warn suggests that the profile structure can be compared against the soldier's service record and personal history. The psychologist needs to hypothesise about the behavioural implications of extreme scores on primary factors as well as for each of the second order factors. These extrapolations from the profile, Warn believes, can be checked against the behavioural records. Examination of the service record and personal history might require a reworking of the hypotheses derived from the 16PF profile, and discrepancies need to be noted so that they can be explored at the interview stage. The interview allows the psychologist to further explore the patterns suggested by the 16PF. Real life instances need to be gathered in order to flesh out the more analytical structure of the profile. Thus, after the interview, Warn believes the psychologist will have a mass of firsthand impressions and profile assessments which can be organised into a coherent write-up.

Warn's (1986) routine approach for the Army psychologist's interpretation of the 16PF is quite functional; the doubt, however, about the overall validity of the 16PF is still a problem. Although Warn's starting point for interpretation is the second-order factors, the primary factors are considered subsequently. Because of the problems with the primaries, noted earlier, there needs to be a clear warning that considerable caution should be exercised in interpreting the primaries. This does add to the responsibility of the individual psychologist. As well as this, O'Gorman (1986) expressed a general concern about the interpretative approach advocated by Warn (1986), suggesting that it runs the risk of confounding personality description with personality prediction. Personality description involves characterising the individual's behaviour in terms of the concepts of a selected theory of personality. Personality prediction involves forecasting the likely future behaviour of the individual in a given situation. It is important to make the distinction, as O'Gorman suggests that the basis for evaluating the validity of the two differ. In the case of personality description, validity is evaluated in terms of the accuracy with which the concepts have been applied. Comparisons with judgements of those who know the individual well or with salient features of the individual's life history can be used. For personality prediction, on the other hand, validity depends on an increase in the efficiency of decision making. Because of this difference, an accurate description of personality does not imply an accurate prediction of future behaviour. The interpretative approach outlined by Warn will help in formulating accurate descriptions of personality. However, the problem of prediction remains.

O'Gorman (1986) believes the problem can be dealt with in two ways. One is to establish empirical relationships between 16PF scores and aspects of performance in the actual situations which are the focus of prediction. However, there are few data of this sort currently available. In their absence, O'Gorman suggests the use of the 'analytic approach', described by Stern and colleagues (Wiggins, 1973). This involves a conceptual analysis of the criterion situation followed by the formulation

of explicit statements of the theoretical relationship between test scores and the features of the criterion identified in the conceptual analysis. This analysis would employ a qualitative rather than a quantitative methodology and draw on the observations of those with immediate experience of the criterion. However, as O'Gorman succinctly puts it "it is only when the assessor is armed with the conceptual analysis and the theoretically based linkages that one can expect the personality description provided by the interpretative approach to lead to improved prediction," (p. 4).

In sum, it must really be asked whether any self-report test can do justice to the subtleties of human personality and behaviour, but if the 16PF is to be used the Army psychologist should always interview the applicant after sighting the 16PF profile. This enables specific hypotheses from the 16PF data to be explored with particular emphasis on secondary factor scores. This is not to imply that there are not more factors than these in the personality questionnaire domain, but rather that, if more exist, they have not been measured with sufficient reliability or independence to be revealed by the questionnaire.

Summary

1. The concept of personality is widely recognised as being central in psychology, yet its nature and the ways in which it can be defined and measured are questions on which psychologists are in considerable disagreement.
2. While theorists tend to disagree over definitions of personality, they tend to agree that in order to perform a systematic exploration of personality's relation to other variables, a definite set of personality factors needs to be specified.
3. Researchers engaged in the question of the number of factors in the personality sphere seem to divide roughly into three positions: Two factors, five-to-eight factors and 13-to-18 factors.
4. Cattell devoted a major segment of his career to the development and refinement of his conception of the personality sphere and the primary instrument for its measurement, the Sixteen Personality Factor Questionnaire (16PF).
5. The 16 PF purports to measure 16 distinct personality traits, yet there is no evidence of the convergent validity of the 16 scales apart from factor loadings and what evidence there is of discriminant validity suggests the primary traits are not clearly differentiated. When coupled with the relatively low internal consistency of the scales and their modest test-retest reliabilities, the psychometric adequacy of the test must be questioned.
6. The Australian Army Psychology Corps uses the 16PF. Since the psychometric adequacy of the questionnaire is in doubt,

psychologists must use caution when interpreting the 16PF profiles.

References

Abdel-Khalek, A.M., Abdel-Sattar, I., & Budek, M.H. (1986). The factorial structure of the 16 PF & EPQ in Egyptian samples: A preliminary study. Personal and Individual Differences, 7, 1, 65-72.

Adcock, N.V., & Adcock, C.J. (1977). The validity of the 16PF personality structure: A large New Zealand Sanysee item analysis. Journal of Behavioural Science, 2, 227-237.

Allport, G.W., & Odbert, H.S. (1936). Trait-names: A psycholinguistic study. Psychological Monographs, 47, 211, 1-171.

American Psychological Association. (1985). Standards for educational and psychological tests and manuals. Washington, D.C.: American Psychological Association.

Anastasi, A. (1982). Psychological testing (fifth ed.). New York: MacMillan.

Becker, W.C. (1961). A comparison of the factor structure and other properties of the 16PF and the Guilford - Martin personality inventories. Educational and Psychological Measurement, 21, 393-404.

Berg, I.A. (1967). Response set in personality assessment. Chicago: Aldine Publishing Company.

Borgatta, E.F. (1964). The structure of personality characteristics. Behavioural Science, 9, 8-17.

Boyle, G.J. (1988). A guide to the military use of the 16PF in personnel selection. Melbourne, Australia: Department of Defence (Army Office), Headquarters Third Military District.

Bundsal, C.A., & Vaughn, D.S.A. (1974). A contrast of the personality structure of college students found in the questionnaire medium by items as compared to parcels. The Journal of Genetic Psychology, 125, 219-224.

Buss, A.H., & Finn, H.M. (1987). Personality: evolutionary heritage and human distinctiveness. Hillsdale, New York: Erlbaum.

Campbell, P.T. (1960). A typology of tests projective and otherwise. Journal of Consulting Psychology, 21, 207-210.

Campbell, P.T., & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56, 81-105.

Cattell, R.B. (1946). Description and measurement of personality. New York: World Book.

Cattell, R.B. (1947). General psychology. Cambridge, MA: Sci-art.

Cattell, R.B. (1950). Personality: a systematic theoretical and factual study. New York: McGraw-Hill.

Cattell, R.B. (1957). Personality and motivation structure and measurement. London: Harrap.

Cattell, R.B. (1965). The scientific analysis of personality. London: Penguin.

Cattell, R.B. (1967). The scientific analysis of personality. Harmondsworth, Middlesex: Penguin.

Cattell, R.B. (1972). The 16PF and basic personality structure: A reply to Eysenck. Journal of Behavioural Science, 1, 169-187.

Cattell, R.B. (1973). Personality and mood by questionnaire. San Francisco: Jossey-Bass.

Cattell, R.B. (1983). Structured personality learning theory. New York: Praeger.

Cattell, R.B., & Bolton, L.S. (1969). What pathological dimensions lie beyond the normal dimensions of the 16PF? A comparison of MMPI & 16PF factor domains. Journal of Consulting & Clinical Psychology, 33, 18-29.

Cattell, R.B., Eber, H.W., & Tatsuoka, M.M. (1980). Handbook for the 16 personality factor questionnaire. Champaign, Illinois: IPAT.

Cattell, R.B., & Gibbons, B.D. (1968). Personality factor structure of the combined Guilford & Cattell personality questionnaires. Journal of Personality & Social Psychology, 9, 107-120.

Cattell, R.B., & Krug, S.E. (1986). The number of factors in the 16PF: A review of the evidence with special emphasis on methodological problems. Educational & Psychological Measurement, 46, 509-522.

Cattell, R.B., & Scheier, I.H. (1961). Predicting anxiety from clinical symptoms of anxiety. Psychiatrika Quarterly Supplement, 35, 114-126.

Cattell, R.B., Tattro, D., & Komlos, E. (1964). The diagnosis and inferred structure of paranoid and non-paranoid schiz, from the 16PF profile. Indian Psychological Review, 1, 52-61.

Cattell, R.B., & Tsujioka, B. (1964). The importance of factor-trueness and validity, versus homogeneity and orthogonality, in test scales. Educational & Psychological Measurement, XXIV, 1.

Comrey, A.L. (1973). A first course in factor analysis. New York: Academic Press.

Comrey, A.L., & Duffy, K.E. (1968). Cattell & Eysenck factor scores related to Comrey personality factors. Multivariate Behavioural Research, 4, 379-392.

Costa, P.T., & McCrae, R.K. (1976). Age differences in personality structure: A cluster analysis approach. J. Geroni, 31, 5, 564-570.

Cronbach, L.J. (1970). Essentials of psychological testing (3rd ed.). New York: Harper.

Digman, J.M., & Takemoto-Chock, N.K. (1981). Factors in the natural language of personality: Re-analysis, comparison, & interpretation of six major studies. Multivariate Behavioural Research, 16, 149-170.

DPsych-A (1985). Introduction of revised 16PF form A + form B, AA Psych Corps Admin Instruction 5/85 (Revised). Canberra, Australia: Department of Defence (Army Office), Directorate of Psychology - Army.

Eber, H.W. (1966). Toward oblique simple structure: Maxplane. Multivariate Behavioural Research, 1, 112-125.

Eysenck, H.J. (1967). The biological basis of personality. Springfield, IL: Charles C. Thomas.

Eysenck, H.J. (1971). On the choice of personality tests for research and prediction. Journal of Behavioural Science, 1, 85-89.

Eysenck, H.J. (1972). Primaries or second-order factors: A critical consideration of Cattell's 16PF battery. British Journal of Social and Clinical Psychology, 11, 265-269.

Eysenck, H.J. (1982). Personality, genetics and behaviour: selected papers. New York: Praeger.

Eysenck, H.J., & Eysenck, S.B.G. (1969). Personality, structure and measurement. London: Routledge & Kegan Paul.

Eysenck, H.J., & Eysenck, S.B.G. (1975). Manual of the Eysenck personality questionnaire. San Diego, CA: Author.

Eysenck, H.J., White, P.O., & Soueif, M.I. (1969). Factors in the Cattell personality inventory. In H.J. Eysenck & S.B.G. Eysenck, et al.(Eds.), Personality structure and measurement. San Diego, CA: Robert Knapp.

Fox, S., Haboucha, S., & Dinur, Y. (1981). The predictive validity of the sixteen personality factors questionnaire relative to three independent criterion measures of military performance. Educational and Psychological Measurement, 41, 515-520.

Gibbons, B.D. (1966). Functional psychological testing. Multivariate Behavioural Research, 1, 140-161.

Goldberg, L.R. (1982). From ace to zombie: Some explorations in the language of personality. In C.D. Spielberger & J.N. Butcher (Eds.), Advances in personality assessment, 1, (pp. 203-234). Hillsdale, NJ: Erlbaum.

Guilford, J.P. (1975). Factors and factors of personality. Psychological Bulletin, 82, 802-814.

Hall, C.S., & Lindzey, G. (1957). Theories of personality. New York: Wiley.

Hogan, R. (1983). Socioanalytic theory of personality. In M.M. Page (Ed.), 1982 Nebraska Symposium on motivation: Personality - Current theory and research. (pp. 55-89). Lincoln Neb: University of Nebraska Press.

Howarth, E. (1976). Were Cattell's 'Personality Sphere' factors correctly identified in the first instance? British Journal of Psychology, 2, 213-230.

Howarth, E., & Browne, J.A. (1971). An item factor analysis of the 16PF. Personality, 2, 117-139.

Howarth, E., & Browne, J.A. (1972). An item factor analysis of the Eysenck personality inventory. British Journal of Social and Clinical Psychology, 11, 162-174.

Levonian, E. (1961). Personality measurement with items selected from the 16PF questionnaire. Educational and Psychological Measurement, 21, 937-946.

McCrae, R.R., & Costa, P.T. (1983). Joint factors in Self-reports and ratings: Neuroticism, extraversion and openness to experience. Personality and Individual Differences, 4, 245-255.

McCrae, R.R., & Costa, P.T. (1985). Updating Norman's "Adequate Taxonomy": Intelligence and personality dimensions in natural language and in questionnaires. Journal of Personality and Social Psychology, 49, 710-721.

McCrae, R.R., & Costa, P.T. (1987). Validation of the five-factor model of personality across instruments and observers. Journal of Personality and Social Psychology, 52, 81-90.

Mershon, B., & Gorsuch, R. (1986). Number of factors in the personality sphere. (Unpublished).

Norman, W.T. (1963). Toward an adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings. Journal of Abnormal and Social Psychology, 66, 574-583.

O'Gorman, J.G. (1986). Warn's guide to the use of the 16PF. (FN 738-2-4). Canberra, Australia: Department of Defence (Army Office), 1st Psychological Research Unit.

Peabody, D. (1984). Personality dimensions through trait inferences. Journal of Personality and Social Psychology, 46, 384-403.

Peterson, D.R. (1965). Scope and generality of verbally defined personality factors. Psychological Review, 72, 48-59

Saville, P., & Blinkhorn, S. (1976). Undergraduate personality by factored scales. Windsor, UK: NFER.

Saville, P., & Munroe, A. (1987). The relationship between the factor model of the occupational personality questionnaires and the 16PF. Canberra, Australia: Proceedings of the 22nd Annual Conference of the Australian Psychological Society.

Sheldon, W.H. (1940). The varieties of human physique: An introduction to constitutional psychology. New York: Harper.

Smith, B.D., & Vetter, H.J. (1982). Theoretical approaches to personality. Englewood Cliffs, NJ: Prentice-Hall.

Spearman, C. (1904). "General Intelligence" objectively determined and measured. American Journal of Psychology, 15, 201-293.

Thurstone, L.L. (1938). Primary mental abilities. Psychometric Monographs, 1.

Wallen, R.W. (1956). Clinical psychology: the study of person. New York: McGraw-Hill.

Warn, J.R. (1986). A guide to the use of the 16PF questionnaire in personnel selection: A military context. (FN 738-2-4). Canberra, Australia: Department of Defence (Army Office), 1st Psychological Research Unit.

Webster, R.K. (1961). Dictionary. New York: Wiley.

Wiggins, J.S. (1973). Personality and prediction: Principles of personality assessment. London: Addison-Wesley.